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The Influence of Wind Stress and River Runoff on a Shelf-Sea Front

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ABSTRACT

Runoff from land gives rise to the formation of a front-jet system separating fresher coastal waters from more saline waters offshore, over some continental shelves, notably in the Mid-Atlantic Bight in winter. Three first-order characteristics of such fronts are the anchor depth H , where the front intersects the bottom, the stretch l , i.e., the distance between its surface and bottom intersections, and the buoyancy contrast b across the front. The three characteristics may be determined from the cross-front property transfer rate, the along-front momentum balance, and the turbulence-energy dissipation rate. Key independent variables are the horizontal buoyancy transport B_x , the friction velocity u_* , and direction θ of the wind, and the Coriolis parameters f . Simple approximate formulae connecting dependent to independent variables are where m , λ and μ are constants of order 300, 1 and 0.1 respectively. The entrainment rate across the front is $\mu u_*^2 f^{-1} \cos\theta$, which is small compared to Ekman transport on some continental shelves, but possibly not on all.

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